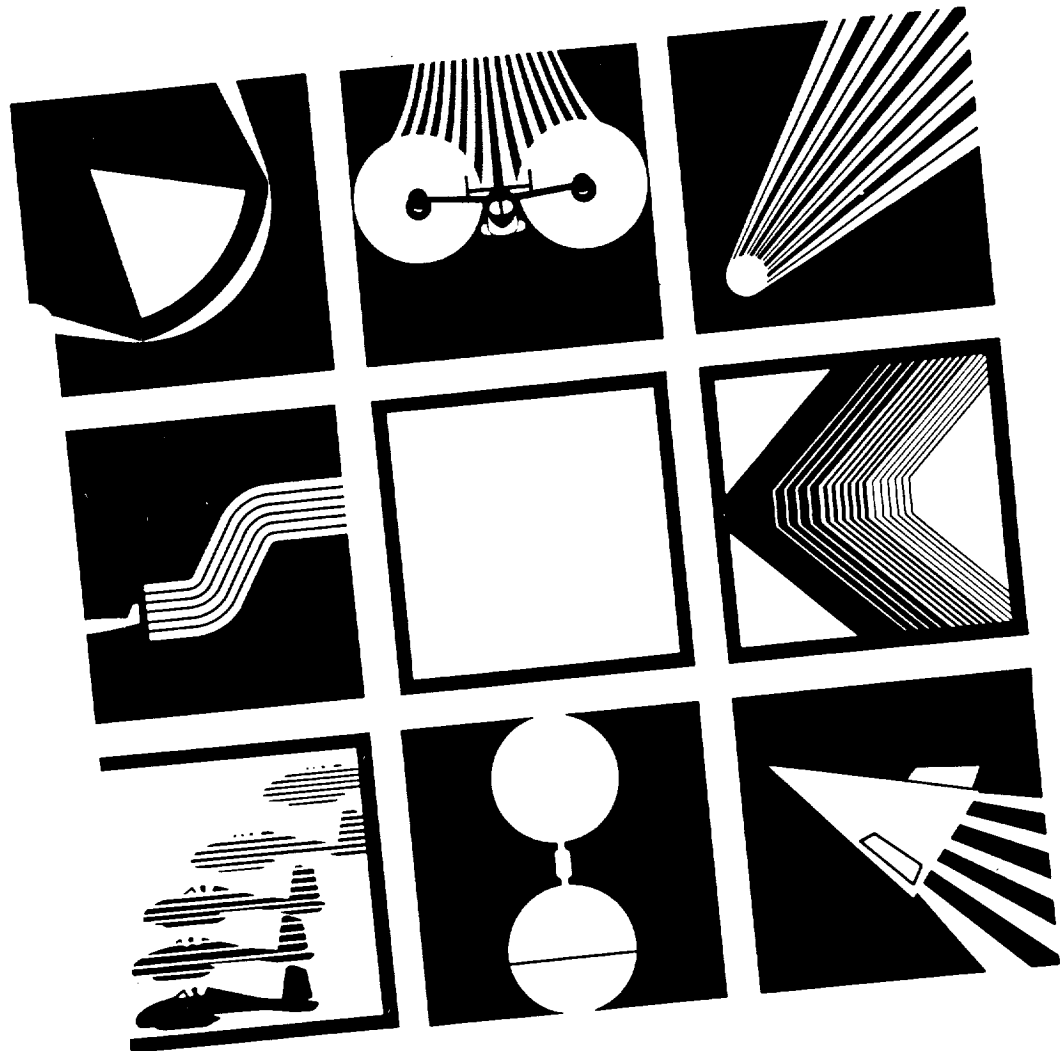


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# The Vision of Ames Research Center



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## THE VISION OF AMES RESEARCH CENTER

### INTRODUCTION

Ames Research Center, a vital field installation of the National Aeronautics and Space Administration, has a long tradition of award-winning advances in aeronautical, space, and life science research. The Center has completed the first step of a comprehensive strategic planning program to ensure its continued effectiveness as a national research laboratory in support of the Nation's aeronautical and space goals. This step resulted in the identification of key areas in which Ames can provide unique capabilities and make significant contributions to major Agency initiatives in the next decade. The path to the 21st Century is one which will bring continued distinction to Ames Research Center for outstanding contributions to science and technology through its exceptional personnel and premier facilities.

### STRATEGIC PLANNING

The strategic planning activity at Ames Research Center involves a broad participation of employees at all levels in setting the Center's direction. This process is intended to provide a base of shared values and awareness in the staff of technical, political, and managerial considerations facing the Center and the Agency. In strategic planning, the definition of the organization as it wishes to be in the future - or the "vision" of the organization - is the first and most difficult task. The Ames vision should:

- Above all, define how the Ames of the future can best support the Agency and the Nation
- Capitalize on our strengths
- Alleviate or reduce the impact of our weaknesses
- Move the Center toward securing the most promising opportunities which can be projected today
- Position the Center to be successful within the context of a wide spectrum of future scenarios

The Ames vision results from an extensive analysis of our internal and external environment. This analysis exposed the most promising future directions in light of the Center's potential and projected opportunities. The vision will provide the framework for evaluating program and project ideas and it will establish a focus for the research activities of the Center.

## THE AMES OF THE FUTURE

Through reports such as "Pioneering the Space Frontier" (National Commission on Space), "Aero 2000", and the "National Aeronautical R&D Goals" (Office of Science and Technology Policy), the future of the civil space and aeronautics programs has been projected and advocated with confidence. These reports provide an exciting framework for the vision of the Ames Research Center of the future.

A characterization of the vision for the Ames of the future is shown in the figure. Each circle or "bubble" in the diagram represents a distinct vision element. The size of the bubble denotes the degree of Center emphasis. The overlapped regions depict synergies between vision elements. In 10 years, the primary emphases at Ames will be associated with the vision elements Humans in Space, Intelligent Systems Research and Computation to Flight, the three large bubbles in the diagram.

The National Commission on Space projects an ever-increasing manned presence in space, spanning the development of Space Station, to Lunar bases, and onward to Mars bases. The first key component of the Ames vision, Humans in Space, responds to the need for extensive basic research to understand the effects of the low gravity environment of space flight on humans and other biological systems. This vision element will also focus on the development of technology to support a safe, productive, and extended-duration human presence in space. Ames is uniquely suited to fulfill this critical role by integrating and expanding an already-established research base in space biology, human factors, and space technology development. Working with the NASA development and operations centers, Ames will provide the research groundwork necessary for the development and operation of extraterrestrial installations by NASA.

In both space and aeronautics, the progression toward highly integrated and automated systems is a prominent element of the technological advances necessary to achieve most future scenarios. The second key element of the Ames vision, Intelligent Systems Research, bridges the space and aeronautics boundaries with the integration of our existing research capabilities in guidance and control, human factors, and artificial intelligence for application to aerospace systems. This critical research and technology development has applications which span manned and unmanned space systems and terrestrial and extraterrestrial highly automated vehicles.

Ames has provided to NASA and the U.S. aerospace community a set of unique capabilities and facilities in aeronautical research and technology development. The third key element of the Ames vision, Computation to Flight, transforms our existing distinct capabilities in computational and experimental aeronautics, flight simulation, and flight research and testing into an iterative integrated process providing the full spectrum of research tools for application to specific vehicle classes and basic aeronautical research problems. The use of highly interactive research tools will become increasingly necessary to achieve improvements in the performance, usefulness, and safety of both terrestrial and space vehicles in the future.

In addition to the three main emphasis areas in the Ames vision, there are several other vision elements which are emphasized on the basis of their importance to mainline NASA directions, the unique capabilities provided by Ames, and the synergetic enhancement of the overall vision. In the area of Space and Earth Sciences, Ames would continue to provide high-quality research focused on the evolution of planetary systems and on the ongoing evolution of Earth ecosystems supported by a fleet of airborne science aircraft essential to the Agency and the scientific community. Projects in support of "Space and Earth Science" and "Humans in Space" of moderate size would be designed and managed in the vision element Space Projects. The vision also includes a continuing emphasis by Ames in the development of enabling research and technology in hypersonic vehicles and probes in the vision element Transatmospherics. In the scope of the vision element Aero-Projects, Ames will perform selected technology development and demonstration projects.

State-of-the-art facilities are crucial to the maintenance of U.S. preeminence in aeronautics and space. Unique facilities, including wind tunnels, simulators, supercomputer systems, platform aircraft, and flight-test ranges, are a fundamental component of the Ames vision. In line with the vision, the Center will maintain national facilities such as the National Full-Scale Aerodynamic Complex, the Unitary Plan Wind Tunnel and the Numerical Aerodynamic Simulation facility in support of our in-house research efforts and joint efforts, and as a service to the U.S. aerospace community. Ames will continue to be known as a national flight research center and existing capabilities will be further strengthened. In addition, Ames will advocate and construct facilities as a means of supporting principal research roles consistent with this vision.

The Center vision builds on the existing strengths of Ames, i.e., the existence of a spectrum of research capabilities in aeronautics, and our expertise in life, space and Earth sciences. The vision retains diversity, yet provides focus for areas of involvement and capitalizes on synergies between research disciplines. It is oriented toward fundamental research and technology development and recognizes the importance of project activities as an integral part of the total research effort. An important characteristic of any vision is its robustness, i.e., its ability to anticipate and capitalize on a changing external environment. This vision is a purposeful balance between space and aeronautics programs, enabling the Center to continue its significant contributions to the Nation's aeronautics efforts while adjusting the Center's mission to better reflect the anticipated future direction of the Nation's civil space program. With this vision, Ames will be a significant contributor to the main work of the Agency for Space Station and beyond for both manned and unmanned programs.

Vision Element: Humans in Space

Narrative:

Ames will play a leading role in conceiving and conducting fundamental research and developing selective technologies which are critical to humans living and working in space and readapting to gravity. Ames will excel in research in human performance and habitability, in the adaptation of humans and other biological systems to the space environment, in the development of life support technologies, and in the development of hardware for life science research for Space Station and for future NASA extraterrestrial installations. Ames will provide support to NASA development and operations centers for major National space programs.

Examples of Program Ideas Consistent with this Vision Element:

Space Biology  
Gravitational Biology  
Space Human Factors  
Telepresence  
Life Support Systems  
EVA technology

Examples of Project Ideas Consistent with this Vision Element:

Closed Environment Life Support Systems (CELSS) technology  
Bioscience Module for Space Station  
Space Suit Technology Development  
Space Station Centrifuge Technology

## Vision Element: Space and Earth Science

### Narrative:

Ames will be known for its research concerning the origin and evolution of stellar and planetary systems, and life thereon. Ames will apply complimentary theoretical, observational, and laboratory capabilities in astrophysics, solar system science, and exobiology to these fundamental questions. Ames will also be known for its scientific contributions to understanding how the Earth systems, especially its atmosphere and ecosystems, have evolved since their formation, how they interact, and how they may be expected to evolve in the future. Ames will operate airborne-science aircraft for the science community in support of these and other Agency goals.

### Examples of Program Ideas Consistent with this Vision Element:

Exobiology Research

Astrophysics

Infrared Astronomy

Planetary Detection, Science and Origin and Atmospheric Modeling

Atmospheric and Ecosystem Science

Climate and Biosphere modeling

Stratosphere-troposphere Exchange

Fires Research

Ozone Depletion

Vision Element: Space Projects

Narrative:

Ames will play a prominent role in the development and operation of a variety of small-to-moderate-sized flying and orbiting observatories and laboratories, planetary probes, and instruments for the purpose of advancing the research goals of the Center.

Examples of Project Ideas Consistent with this Vision Element:

Earth Observation Systems (EOS) simulator/science  
Upper Atmosphere Research Satellite (UARS) validation  
IR Spartan Module  
SOFIA (telescope, optics, and detector technology, instruments, operations)  
SIRTF (telescope, optics, and detector technology, instruments, operations)  
SETI  
CRAF Instruments  
Astrometric telescope facility, telescope, operations  
Tethered satellites  
Lifesat

## Vision Element: Intelligent Systems Research

### Narrative:

Ames will expand and integrate the areas of human factors, guidance and control, and artificial intelligence into a unique program of Intelligent Systems Research. The complimentary goals of this program are to optimize the interface between human and machine, and where appropriate to automate human functions. Both basic and applied research will be driven by significant applications in such major Agency missions as the Space Station, highly automated aircraft, and planetary exploration. Through its powerful array of existing computational, ground, and flight resources and international reputation in the contributing disciplines, Ames will become a national center for research in intelligent systems and its application to aerospace systems.

### Examples of Program Ideas Consistent with this Vision Element:

- Human Factors
- Computer Science
- Artificial Intelligence
- Telescience and telerobotics
- Manned Simulation
- Control Theory

### Examples of Project Ideas Consistent with this Vision Element:

- Aircraft Automation
- Space Systems Autonomy Demonstration
- Army-NASA Aircraft-Aircrew Integration
- Virtual Environment Workstation
- Automation of National Airspace System



## Vision Element: Computation to Flight

### Narrative:

Ames will maintain excellence in computational analysis, wind tunnel research, flight simulation, and flight research. Research emphasis will be on the synergistic integration of these capabilities to create and validate new predictive methodologies and to develop new rotorcraft, powered-lift, high-performance, and hypersonic vehicle concepts. This research will also advance the elements of basic aeronautics which determine component characteristics and contribute to total vehicle performance. Ames' facilities and capabilities will continue to support important national and industry needs.

### Examples of Program Ideas Consistent with this Vision Element:

- Physics of Turbulence
- Vortical Flow Control
- High Angle-of-attack Aerodynamics
- Drag Reduction and Transition Control
- Microgravity Fluid Mechanics
- Interdisciplinary Aerophysics
- Propulsion- Flight Control Integration
- Human Factors
- Algorithm and Instrumentation Development
- Vehicle Concept Development

Vision Element: Aero-Projects

Narrative:

Ames will conduct selected aeronautical technology projects, including joint and/or cooperative activities with industry and other Government agencies. These activities will extend the range of data beyond laboratory or ground-based capabilities, probe previously unexplored flight regimes, and focus research efforts to accelerate technology readiness. Primary emphasis will be on high performance, powered-lift, and rotary-wing aircraft, on other unique vehicles that highlight NASA-developed technology, and on interdisciplinary flight-systems integration.

Examples of Program Ideas Consistent with this Vision Element:

Integrated Controls Research and Technology  
Crew Station Research and Development  
Agility and Maneuverability Concepts (Nap-of-the-Earth)  
Automated Control Research and Development (Automated Wingman)

Examples of Project Ideas Consistent with this Vision Element:

Supersonic STOVL  
Oblique Winged Aircraft  
Autonomous Rotorcraft  
High-speed Tilt-Rotor  
Low-Observable Rotorcraft  
Transatmospheric Vehicles and Probes  
High Alpha  
X-Wing

Vision Element: Transatmospherics

Narrative:

Ames will provide leadership in basic research and technology development, in selected areas, for the development of aerospace systems which transport humans and materials to and from space and within the atmospheres of other bodies in the solar system. Ames will excel in the areas of fluid and thermal physics, re-entry systems, and hypersonic vehicle flight research. Vehicles to be studied are those which travel at Mach numbers of 5 or greater. These include hypersonic aerospacecraft, atmospheric entry probes, and space cargo transports.

Examples of Program Ideas Consistent with this Vision Element:

Aerothermodynamics  
Thermo-Physics  
Thermal Protective Materials Development  
Computational Chemistry  
Hypersonic Vehicle Flight Research  
Re-entry Systems

Examples of Project Ideas Consistent with this Vision Element:

NASP Program  
AOTV  
Planetary Probes

## Major Facilities Supporting the Vision

### Existing Facilities

### Future Facilities and Modifications

#### Wind Tunnels:

National Full-Scale Aerodynamics Complex  
7X10' Wind Tunnels  
Unitary Plan Wind Tunnel (UPWT)  
12', 14', 6x6', 2x2' Wind Tunnels  
Fluid Mechanics Laboratory  
3.5 Ft Wind Tunnel  
2x9 Turbulent Duct  
Ballistic Ranges & Shock Tubes  
Hot Structures Facility

NFAC Enhancements  
Real Gas Wind Tunnel  
UPWT Automation and Enhancement  
12' Wind Tunnel Restoration  
Full-Scale Open-Throat Anechoic Tunnel  
3.5 Ft. Wind Tunnel Upgrades  
Arc-Jet Complex Upgrades

#### Computational Facilities:

Numerical Aerodynamic Simulation Facility  
Central Computing Facility

Enhanced NAS

#### Simulation Facilities:

Flight Systems Research Laboratory  
Vertical Motion Simulator  
Man-Vehicle Systems Research Facility  
Proximity Operations Simulator

Rotorcraft Systems Integration Simulator (RSIS)  
Aircraft Automation Facility  
Crew Station Research & Development Facility  
Simulator Enhancements

#### Airborne Science and Research Aircraft & Facilities:

KAO, ER-2, U-2's, DC-8, C-130  
Program Support Aircraft  
Airborne Science Operations Facilities  
Dryden Flight Research Facilities  
Crows Landing  
Dryden Remotely Augmented Vehicle Facility

Integrated Test Facility  
Hydrogen Structural Test Fac.  
SOFIA  
Engine Run-up Pad

## Major Facilities Supporting the Vision (con't)

### Existing Facilities

### Future Facilities and Modifications

#### Life and Space Science Research Facilities:

Cooled Mirror Facility  
Liquid Helium Facility  
Pioneer Operations Center  
Animal Control Facility  
Human Bed Rest Facility  
Human and Animal Centrifuges  
STS Spacelabs  
Environmental Chambers  
Plant Research Laboratories  
Mars Aeolian Laboratory  
Vestibular Research Laboratory

Space Suit Test Facility  
Lifesat  
Space Station Research Lab  
Man-Rated Mission Simulator  
1.8m Space Station Centrifuge  
Space Station Manned Centrifuge  
Life Support System Development  
Facility

#### Intelligent Systems Research Facilities:

Human Factors, Guidance and  
Control, Artificial Intelligence  
Laboratories

Human Performance Research Lab.  
Automation Sciences Research Fac.  
Telescience Facility

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